DYNAMIC PRESSURE BEARING

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Applicant: KONICA CORP

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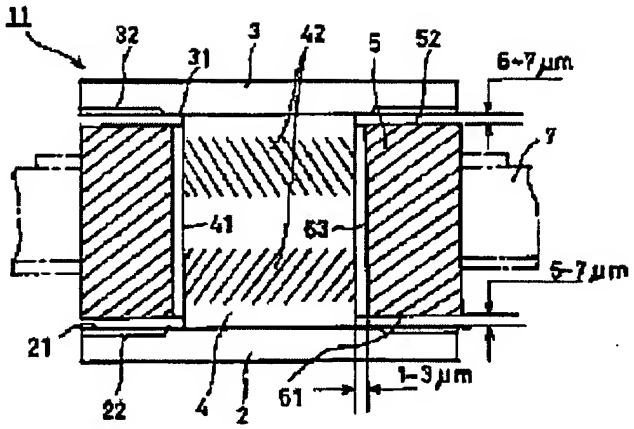
Abstract of **JP7259849**

PURPOSE:To prevent a peripheral part of a rotary unit, particularly increased with a rotational speed, from coming into contact with a thrust bearing, even in the case of setting the rotary unit tilted or setting it up horizontally.

CONSTITUTION:A device has a radial bearing 4, thrust bearing 2, 3 provided in both ends of the radial bearing 4 and a rotary unit 5 rotatably provided in the radial bearing 4 and the thrust bearings 2, 3. At the time of rotating the rotary unit 5 received by the radial bearing and the thrust bearings, a minimum value of clearance width, generated between the rotary unit and the thrust bearing, is increased larger than a minimum value of clearance width generated between the radial bearing and the rotary unit.



Bibliography

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G02B 26/10 102
[Request for Examination] Un-asking.
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[Translation done.]

* NOTICES *

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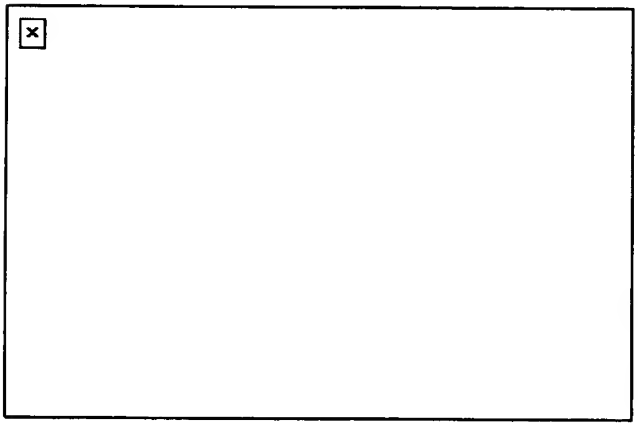
Epitome

(57) [Abstract] (******)

[Objects of the Invention] Also when body of revolution is an inclination setup or level installation, it is made for the periphery of the body of revolution to which especially rotational speed increased not to contact thrust bearing.

[Elements of the Invention] It has radial bearing 4 and the thrust bearing 2 and 3 prepared in both ends of this radial bearing 4, and has the body of revolution 5 prepared in said radial bearing 4 and said thrust bearing 2 and 3 free [rotation]. When said body of revolution 5 wins popularity and rotates by said radial bearing and said thrust bearing, the minimum value of gap width of face produced between said body of revolution and said thrust bearing serves as size from the minimum value of gap width of face produced between said radial bearing and said body of revolution.

[Translation done.]



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* NOTICES *

CLAIMS

[Claim(s)]

[Claim 1] A hydrodynamic bearing characterized by the minimum value of gap width of face produced between said body of revolution and said thrust bearing serving as size from the minimum value of gap width of face produced between said radial bearing and said body of revolution when said body of revolution wins popularity and rotates by said radial bearing and said thrust bearing in a hydrodynamic bearing which has radial bearing and thrust bearing prepared in both ends of this radial bearing, and has body of revolution prepared in said radial bearing and said thrust bearing free [rotation].

[Claim 2] A hydrodynamic bearing according to claim 1 characterized by forming a slot for dynamic pressure generating in at least both said radial bearing, said thrust bearing, or one side in said hydrodynamic bearing.

[Claim 3] It is the hydrodynamic bearing according to claim 1 to 2 characterized by contacting radial bearing with a peripheral speed small at least when said body of revolution contacts said bearing.

[Claim 4] Said radial bearing is a hydrodynamic bearing according to claim 1 to 3 characterized by being formed with ceramics.

[Claim 5] Radial bearing Body of revolution which has thrust bearing prepared in both ends of this radial bearing, and was prepared in said radial bearing and said thrust bearing free [rotation] It is the hydrodynamic bearing equipped with the above, and is characterized by said radial bearing and forming a slot for dynamic pressure generating in said body of revolution.

[Claim 6] It is the hydrodynamic bearing according to claim 5 characterized by contacting radial bearing with a peripheral speed small at least when said body of revolution contacts said bearing.

[Claim 7] Said radial bearing is a hydrodynamic bearing according to claim 5 to 6 characterized by being formed with ceramics.

[Claim 8] A hydrodynamic bearing characterized by the minimum value of gap width

of face produced between said body of revolution and said thrust bearing serving as size from the minimum value of gap width of face produced between said radial bearing and said body of revolution when said body of revolution wins popularity and rotates by said radial bearing and said thrust bearing in a hydrodynamic bearing which has radial bearing and thrust bearing prepared in an end of this radial bearing, and has body of revolution prepared in said radial bearing and said thrust bearing free [rotation].

[Claim 9] A hydrodynamic bearing according to claim 8 characterized by forming a slot for dynamic pressure generating in at least both or one side of said radial bearing and said thrust bearing in said hydrodynamic bearing.

[Claim 10] It is the hydrodynamic bearing according to claim 8 to 9 characterized by contacting radial bearing with a peripheral speed small at least when said body of revolution contacts said bearing.

[Claim 11] Said radial bearing is a hydrodynamic bearing according to claim 8 to 10 characterized by being formed with ceramics.

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* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the hydrodynamic bearing of the rotary machine which enabled high-speed rotation of body of revolution by forming the slot for dynamic pressure generating between body of revolution and a nonrotation object, and forming a gap between body of revolution and a nonrotation object in an operation of said slot for dynamic pressure generating by rotation of body of revolution.

[0002]

[Description of the Prior Art] For installing the body of revolution using a hydrodynamic bearing generally, level installation has been to the base. And it

introduces into said slot for dynamic pressure generating which prepared the wind generated by high-speed rotation of body of revolution in the nonrotation object, and by said wind, a hydrodynamic bearing forms the air gap of several micrometer unit between nonrotation dignity and a body-of-revolution side by applying wind pressure more powerful than this slot for dynamic pressure generating to said body-of-revolution side, it is reducing resistance between a nonrotation object and body of revolution, and enables high-speed rotation of body of revolution. Said fixed radial bearing and the hydrodynamic bearing used for the polygon mirror which carries out high-speed rotation at the rotational frequency of 3000 or more rpm while floating from the slot for dynamic pressure generating which prepared in thrust bearing in the air gap of several micrometer unit are also known, and the above body of revolution is (JP,4-38330,Y, 5-16574).

[0003]

[Problem(s) to be Solved by the Invention] By the wind which will be generated by the slot for dynamic pressure generating with rotation of body of revolution if the above hydrodynamic bearings are installed horizontally as mentioned above, as mentioned above, while a nonrotation object and body of revolution hold a several micrometers air gap, body of revolution can maintain rotation. When it is used for rotation of the polygon mirror for laser exposure currently used for the body of revolution which used said hydrodynamic bearing by a small printer, image recording equipment, etc., it may become impossible to related waterworks common arrange [of an installation or components arrangement]. Then, when inclination arrangement of said hydrodynamic bearing is carried out according to an installation with the body of revolution in which said polygon mirror was formed, the air gap formed at intervals of several micrometers formed as mentioned above in the slot for dynamic pressure generating is not held, but the accident to which a part of body of revolution contacts an opposite aspect may be caused. As mentioned above, rotation of a polygon mirror is rotated at the rotational frequency of 3000 or more rpm, and the rotational speed of a rotation periphery is increasing especially from the center-of-rotation section of body of revolution. When inclination arrangement of the body of revolution is carried out as mentioned above, there is a defect to which maintenance by said air gap cannot be performed, but the periphery of body of revolution contacts said a part of thrust bearing by external factors, such as vibration.

[0004] This invention is considered especially in order to improve the above defects. Namely, a hydrodynamic bearing is constituted so that the gap of the radial bearing which receives body of revolution, and the inside of thrust bearing, body of revolution and thrust bearing can be set up more widely than the gap of said body of revolution and radial bearing, and it aims at having made it the periphery of said body of revolution to which especially rotational speed increased also in level installation not contact thrust bearing in the condition that an inclination setup of the body of revolution was carried out.

[0005]

[Means for Solving the Problem] Become size from the minimum value of gap width of face which the minimum value of gap width of face produced between said body of revolution and said thrust bearing when said body of revolution wins popularity by said radial bearing and said thrust bearing in a hydrodynamic bearing which has body of revolution which has thrust bearing prepared [in / in order that this invention may attain said purpose / claim 1] in both ends of radial bearing and this radial bearing, and was prepared free [rotation to said radial bearing and said thrust bearing] and it rotates produces between said radial bearing and said body of revolution. In claim 2, a slot for dynamic pressure generating should be formed in at least both said radial bearing, said thrust bearing, or one side in said hydrodynamic bearing. In claim 3, when said body of revolution contacts said bearing, contact radial bearing with a peripheral speed small at least. In claim 4, said radial bearing should be formed with ceramics. In claim 5, it has radial bearing and thrust bearing prepared in both ends of this radial bearing. Said radial bearing, In a hydrodynamic bearing which has body of revolution prepared in said thrust bearing free [rotation] said body of revolution Said radial bearing, When you win popularity and rotate by said thrust bearing, it is the hydrodynamic bearing to which the minimum value of gap width of face produced between said body of revolution and said thrust bearing serves as size from the minimum value of gap width of face produced between said radial bearing and said body of revolution, and a slot for dynamic pressure generating should be formed in said radial bearing and said body of revolution. In claim 6, when said body of revolution contacts said bearing, contact radial bearing with a peripheral speed small at least. In claim 7, said radial bearing should be formed with ceramics. Have radial bearing and thrust bearing prepared in an end of this radial bearing in claim 8, and in said radial bearing and a hydrodynamic bearing which has body of revolution prepared in said thrust bearing free [rotation], when said body of revolution wins popularity and rotates by said radial bearing and said thrust bearing, become size from the minimum value of gap width of face which the minimum value of gap width of face produced between said body of revolution and said thrust bearing produces between said radial bearing and said body of revolution. In claim 9, a slot for dynamic pressure generating should be formed in at least both or one side of said radial bearing and said thrust bearing in said hydrodynamic bearing. In claim 10, when said body of revolution contacts said bearing, contact radial bearing with a peripheral speed small at least. In claim 11, said radial bearing is attained by being formed with ceramics.

[0006]

[Example] Drawing 1 shows the rotation means for supporting 1 of a polygon mirror, forms the tabular thrust bearing 2 and 3 in these rotation means for supporting 1 up and down, and forms this thrust bearing 2 and the hydrodynamic bearing 11 which fixed the cylinder-like radial bearing 4 so that it might be inserted among three. And the slots 22, 32, and 42 for dynamic pressure generating are respectively formed in the slideways 21 and 31 of said thrust bearing 2 and 3, and the slideway 41 of radial

bearing 4. While forming the body of revolution 5 in which the opposed faces 51, 52, and 53 formed free [rotation] to said slideways 21, 31, and 41 were formed, this body of revolution 5 forms said radial bearing 4 so that it may become the center of rotation, and fixes and forms the polygon mirror 7 in the periphery of said body of revolution 5 with the attachment members 6 and 61. Stator-coil 6A is prepared in said attachment member 6, the magnet 8 which countered said stator-coil 6A is formed in said rotation means for supporting 1, and induction rotation of the body of revolution 5 is carried out at high speed by energizing to said stator-coil 6A.

[0007] Drawing 2 shows a gap in case said body of revolution 5 rotates between said thrust bearing 2 and 3 and radial bearing 4. Between said slideways 21 and 31, the opposed face 51 which countered, and 52 is set to 5-7 micrometers at said body of revolution 5 with the slideways 21 and 31 in which the slots 22 and 32 for dynamic pressure generating of said thrust bearing 2 and 3 were formed, and said slots 22, 32, and 42 for dynamic pressure generating are formed so that a 1-3-micrometer air gap may be held for between the slideway 41 of said radial bearing 4, and the opposed face 53 of said body of revolution 5. When high-speed rotation of said body of revolution 5 and polygon mirror 7 is carried out by the above setup, even if the rotation location of said body of revolution 5 displaces some by inclination arrangement or vibration as mentioned above, the opposed faces 51 and 52 of body of revolution 5 do not contact the slideways 21 and 31 of said thrust bearing 2 and 3, but it is only that the opposed face 53 of body of revolution 5 contacts the slideway 41 of radial bearing 4 somewhat. In addition, since said radial bearing 4 prevents the wear and pyrexia by contact, it can also be formed by ceramic material etc.

[0008] Drawing 3 like said drawing 2 as a gap in case said body of revolution 5 rotates between said thrust bearing 2 and 3 and radial bearing 4 Between said slideways 21 and 31, the opposed face 51 which countered, and 52 is set to 5-7 micrometers with the slideways 21 and 31 of said thrust bearing 2 and 3 at said body of revolution 5. Said slots 22, 32, and 42 for dynamic pressure generating are formed so that a 1-3-micrometer air gap may be held for between the slideway 41 of said radial bearing 4, and the opposed face 53 of said body of revolution 5. And this example establishes the slot 511,521 for dynamic pressure generating in the opposed faces 51 and 52 of said body of revolution 5 instead of said slots 22 and 32 for dynamic pressure generating established in the slideways 21 and 31 of said thrust bearing 2 and 3. Even when it constitutes as mentioned above and high-speed rotation of said body of revolution 5 and polygon mirror 7 is carried out, and even when the rotation location of said body of revolution 5 displaces some by inclination arrangement or vibration as mentioned above, the opposed faces 51 and 52 of body of revolution 5 do not contact the slideways 21 and 31 of said thrust bearing 2 and 3, but it is only that the opposed face 53 of body of revolution 5 contacts the slideway 41 of radial bearing 4 somewhat. In addition, since said radial bearing 4 prevents the wear and pyrexia by contact, it can also be formed by ceramic material etc.

[0009] Drawing 4 is other examples of said drawing 2 , and is the configurations of

having formed only this thrust bearing 2 among said thrust bearing 2 and 3. Also in this example, between the slideway 21 of said thrust bearing 2, and said body of revolution 5 and the opposed face 51 which countered is set to 5-7 micrometers, and said slots 22 and 42 for dynamic pressure generating are formed so that a 1-3-micrometer air gap may be held for between the slideway 41 of said radial bearing 4, and the opposed face 53 of said body of revolution 5. This example by and said slot 22 for dynamic pressure generating established in the slideway 21 of said thrust bearing 2 and the slot 42 for dynamic pressure generating of said radial bearing 4 Even when [said] high-speed rotation of body of revolution 5 and the polygon mirror 7 is carried out similarly, even if the rotation location of said body of revolution 5 displaces some by inclination arrangement or vibration as mentioned above The opposed face 51 of body of revolution 5 does not contact the slideway 21 of said thrust bearing 2, but it is only that the opposed face 53 of body of revolution 5 contacts the slideway 41 of radial bearing 4 somewhat. In addition, since said radial bearing 4 prevents the wear and pyrexia by contact, it can also be formed by ceramic material etc.

[0010] To the radial bearing 4 of the hydrodynamic bearing 11 in said drawing 2 , and thrust bearing 2 and 3, drawing 5 is what showed the gap conditions at the time of rotation of body of revolution 5, sets respectively between the slideway 41 of radial bearing 4, and the opposed face 53 of body of revolution 5 to R1 and R2, and sets respectively between the slideways 21 and 31 of thrust bearing 2 and 3, the opposed face 51 of body of revolution 5, and 52 to t1 and t2. And at the time of rotation of body of revolution 5, when it is $t1<t2$ and $R1<R2$, it sets up so that it may be set to $t1>R1$.

[0011] In drawing 1 of said example, drawing 2 , drawing 3 , and drawing 5 , the slots 22 and 32 for dynamic pressure generating established in the slideways 21 and 31 of thrust bearing 2 and 3 may be established only in one slideway 21 or slideway 31. Moreover, the slot 511,521 for dynamic pressure generating of said body of revolution 5 may also be established only in one side.

[0012] Drawing 6 (a) and (b) are other examples of said drawing 2 . Drawing 6 (a) of this example makes the 21 or 31st page of said slideway in said thrust bearing 2 and 3 an inclined plane 211,311. That is, this inclined plane 211,311 is made to incline so that it may separate one by one toward the method of outside to the opposed faces 51 and 52 of said body of revolution 5 which formed the polygon mirror 7 toward the method of outside [slideway / 41 / of radial bearing 4], and sets to 2-5 micrometers maximum distance of the thrust bearing 2 and 3 produced by this inclination. Moreover, it is made into 1-3 micrometers like said drawing 2 between the slideway 41 of said radial bearing 4, and the opposed face 53 of said body of revolution 5. Therefore, especially the periphery location of the 51 or 52nd page of said opposed face is constituted so that it may separate from said inclined plane 211,311 greatly. Next, drawing 6 (b) of this example makes said slideways 21 and 31 in said thrust bearing 2 and 3 the curved surface-like inclined plane 212,312. That is,

this inclined plane 212,312 is made to incline by the shape of a curved surface so that it may separate one by one to said opposed faces 51 and 52 toward the method of outside [slideway / 41 / of radial bearing 4], and sets to 2-5 micrometers maximum distance of the thrust bearing 2 and 3 produced by this inclination. Moreover, it is made into 1-3 micrometers like said drawing 2 between the slideway 41 of said radial bearing 4, and the opposed face 53 of said body of revolution 5. Therefore, like said drawing 6 (a), the periphery location of the 51 or 52nd page of said opposed face is constituted so that it may separate from the inclined plane 212,312 of the shape of said curved surface greatly.

[0013] In the example of drawing 6 (a) constituted as mentioned above and (b), when the body of revolution 5 which formed the polygon mirror 7 is rotated at the rotational frequency of 3000 or more rpm, the opposed face 53 of body of revolution 5 is rotated in the slot 42 for dynamic pressure generating established in radial bearing 4, holding said 1-3-micrometer gap. In that case, even if incline, and it installs a hydrodynamic bearing 11 or vibration generates it as mentioned above, the opposed faces 51 and 52 of said body of revolution 5 do not contact the periphery section of the inclined plane 211,311,212,312 inclined and formed in thrust bearing 2 and 3.

[0014] Drawing 7 (a) and (b) are other examples of said drawing 2 . Drawing 7 (a) of this example makes said opposed faces 51 and 52 in said body of revolution 5 which formed said polygon mirror 7 an inclined plane 511,521. That is, this inclined plane 511,521 is 2-5 micrometers about the maximum distance of the body of revolution 5 which is made to incline so that it may separate one by one toward the method of outside to the slideways 21 and 31 of said thrust bearing 2 and 3, and is produced by this inclination. It carries out. Moreover, it is made into 1-3 micrometers like said drawing 2 between the slideway 41 of said radial bearing 4, and the opposed face 53 of said body of revolution 5. Therefore, especially the periphery section of said body of revolution 5 consists of slideways 21 and 31 of said thrust bearing 2 and 3 so that it may separate greatly by the inclination. Drawing 7 (b) makes said opposed faces 51 and 52 in said body of revolution 5 which formed said polygon mirror 7 the curved surface-like inclined plane 512,522. That is, the inclined plane 512,522 of the shape of this curved surface is 2-5 micrometers about the maximum distance of the body of revolution 5 which is made to incline so that it may separate one by one toward the method of outside to the slideways 21 and 31 of said thrust bearing 2 and 3, and is produced by this inclination. It carries out. Moreover, it is made into 1-3 micrometers like said drawing 2 between the slideway 41 of said radial bearing 4, and the opposed face 53 of said body of revolution 5. Therefore, especially the periphery section of said body of revolution 5 consists of slideways 21 and 31 of said thrust bearing 2 and 3 so that it may separate greatly by the inclination.

[0015] In the example of drawing 7 (a) constituted as mentioned above and (b), when the body of revolution 5 which formed the polygon mirror 7 is rotated at the rotational frequency of 3000 or more rpm, the opposed face 53 of body of revolution

5 is rotated in the slot 42 for dynamic pressure generating established in radial bearing 4, holding said gap of 1-3 micrometers. In that case, even if incline, and it installs a hydrodynamic bearing 11 or vibration generates it as mentioned above, the inclined plane 511,521,512,522 formed in the opposed faces 51 and 52 of said body of revolution 5 does not contact the periphery section of the slideways 21 and 31 of thrust bearing 2 and 3.

[0016] Drawing 8 is other examples of said drawing 2 , drawing 3 , drawing 4 , drawing 6 (a), (b), drawing 7 (a), and (b), and makes the 21 or 31st page of said slideway in said thrust bearing 2 and 3 an inclined plane 213,313. That is, this inclined plane 213,313 is made to incline so that it may separate one by one toward the method of outside to the opposed faces 51 and 52 of said body of revolution 5 which formed the polygon mirror 7 toward the method of outside [slideway / 41 / of radial bearing 4]. Moreover, it is made into 1-3 micrometers like said drawing 2 between the slideway 41 of said radial bearing 4, and the opposed face 53 of said body of revolution 5. Moreover, let said opposed faces 51 and 52 in said body of revolution 5 which formed said polygon mirror 7 be the curved surface-like inclined planes 513,523. That is, the inclined plane 513,523 of the shape of this curved surface is made to incline in the shape of a curved surface so that it may separate one by one toward the method of outside to said inclined plane 213,313 of said thrust bearing 2 and 3. It estranges greatly and the body-of-revolution 5 periphery edge produced by the inclination of the two directions of the inclined plane 213,313 of said thrust bearing 2 and 3 and the inclined plane 513,523 of the shape of a curved surface of body of revolution 5 and the periphery edge of the inclined plane 213,313 of said thrust bearing 2 and 3 are 4-10 micrometers about the maximum distance. It carries out. Therefore, especially the periphery location of body of revolution 5 is constituted so that it may separate greatly mutually.

[0017] In the example of drawing 8 constituted as mentioned above, when the body of revolution 5 which formed the polygon mirror 7 is rotated at the rotational frequency of 3000 or more rpm, the opposed face 53 of body of revolution 5 is rotated in the slot 42 for dynamic pressure generating established in radial bearing 4, holding said gap of 1-3 micrometers. In that case, even if incline, and it installs a hydrodynamic bearing 11 or vibration generates it as mentioned above, the periphery section of the inclined plane 513,523 of the shape of a curved surface formed in said body of revolution 5 and the inclined plane 213,313 of thrust bearing 2 and 3 is not contacted.

[0018]

[Effect of the Invention] The hydrodynamic bearing in this invention is compared with the air gap between thrust bearing and said body of revolution as mentioned above. Since contact to the body-of-revolution side of the direction of a periphery where it constitutes in so that the air gap between the opposed faces of this body of revolution that counters the radial bearing used as a medial axis may be made small, and especially the speed of body of revolution increases, and thrust bearing

was prevented It can prevent that the body of revolution which prepared the polygon mirror etc. contacts thrust bearing, and will be in the condition of "galling" (condition which body of revolution and bearing contacted, and damaged the mutual contact surface, or was burned). Therefore, even if it carries out inclination installation of the body of revolution which prepared the polygon mirror if needed or vibration is added from the exterior, the rotation stabilized in the rotational speed of 3000 or more rpm in rotational speed for a long period of time can be held.

[0019] Moreover, the image formation equipment which used the polygon mirror which increased said rotational frequency, or a printer is written as raising image quality more, taking out an output at high speed, and the configuration that contacts in the location where peripheral velocity is low, and is effective in the ability of the width of face of selection of the bearing quality of the material to perform breadth and a cost cut because the energy of the above "galling" becomes low.

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The cross section showing the polygon mirror which used the hydrodynamic bearing of this invention.

[Drawing 2] The cross section showing the hydrodynamic bearing and each gap value of this invention.

[Drawing 3] The cross section of other examples showing the hydrodynamic bearing and each gap value of this invention.

[Drawing 4] The cross section of other examples showing the hydrodynamic bearing and each gap value of this invention.

[Drawing 5] The cross section showing the hydrodynamic bearing of this invention, and a setup of each gap value.

[Drawing 6] The cross section showing other examples in the hydrodynamic bearing of this invention.

[Drawing 7] The cross section showing other examples in the hydrodynamic bearing of this invention.
[Drawing 8] The cross section showing other examples in the hydrodynamic bearing of this invention.
[Description of Notations]
1 Rotation Means for Supporting of Polygon Mirror
2 Three Thrust bearing
4 Radial Bearing
5 Body of Revolution
7 Polygon Mirror
22, 32, 42,511,521 Slot for dynamic pressure generating
21, 31, 41 Slideway
51, 52, 53 Opposed face

[Translation done.]

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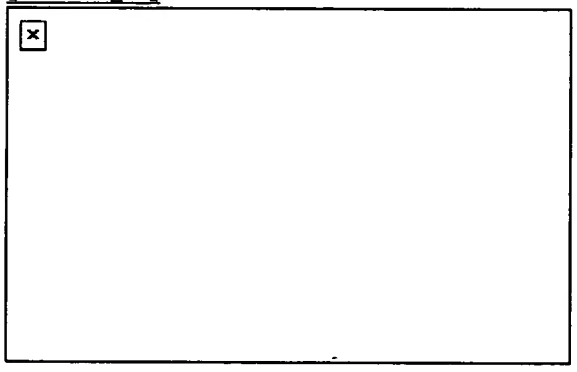
DRAWINGS

[Drawing 1]



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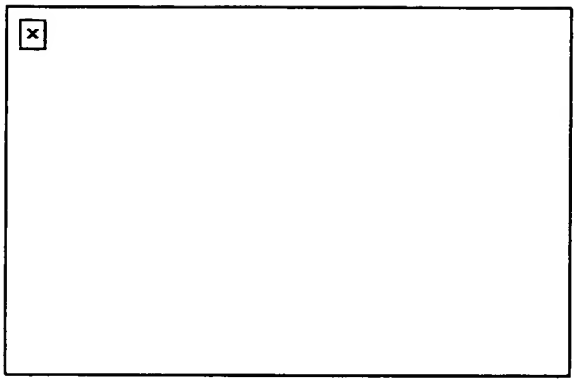

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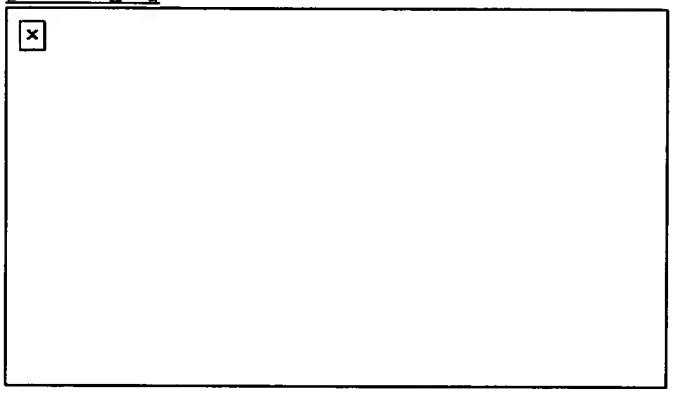

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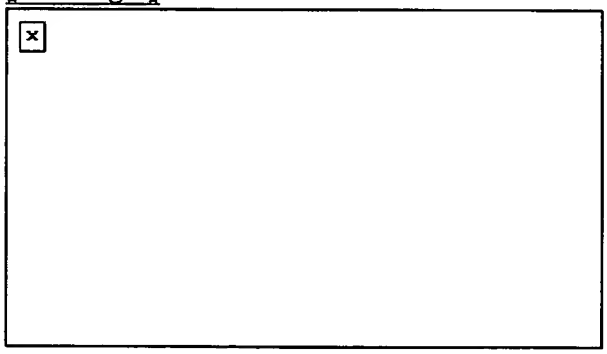

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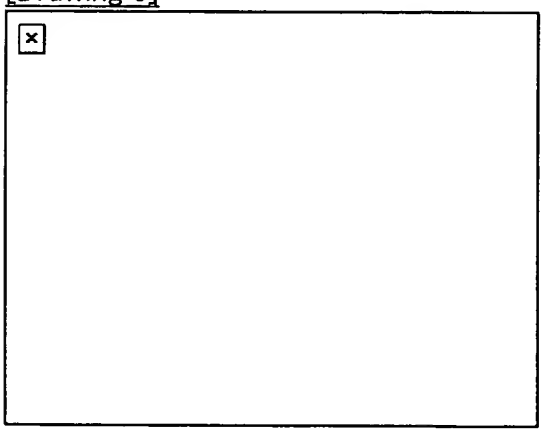

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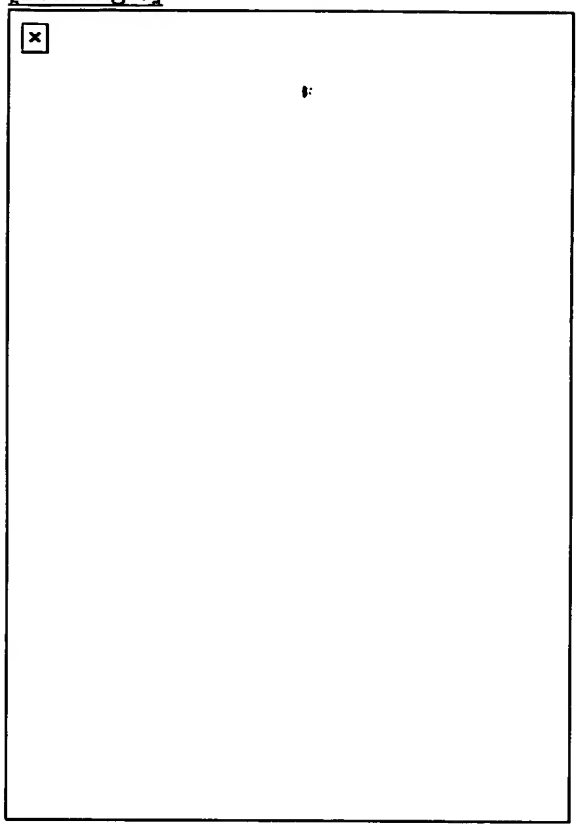
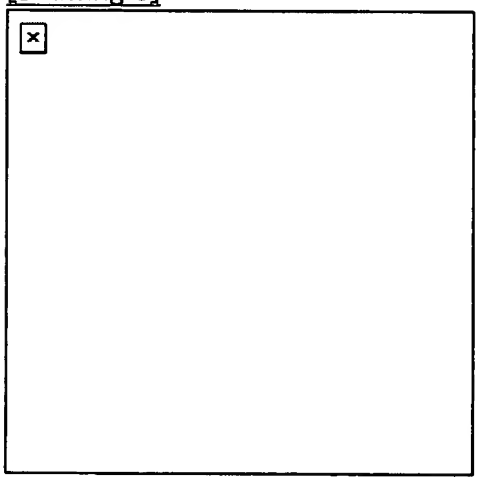


[Drawing 8]



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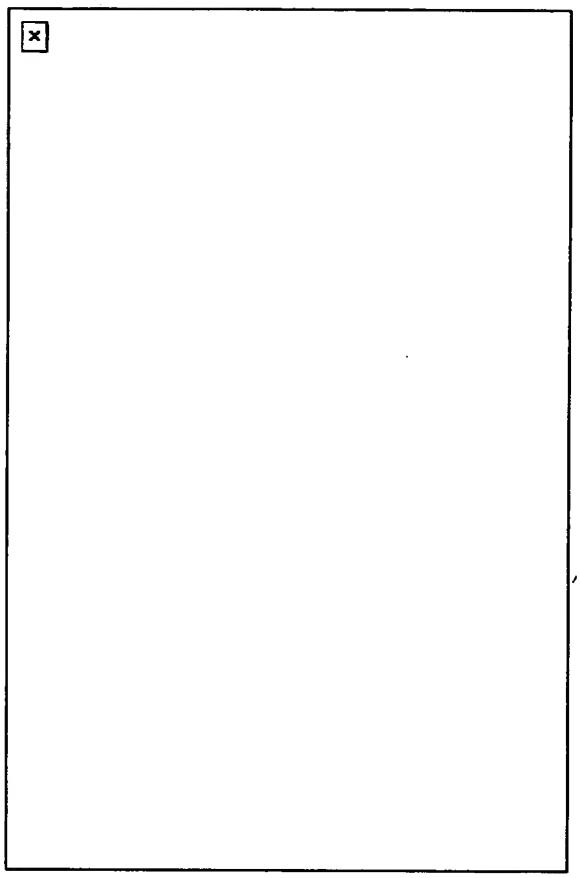

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G02B 26/10	102			

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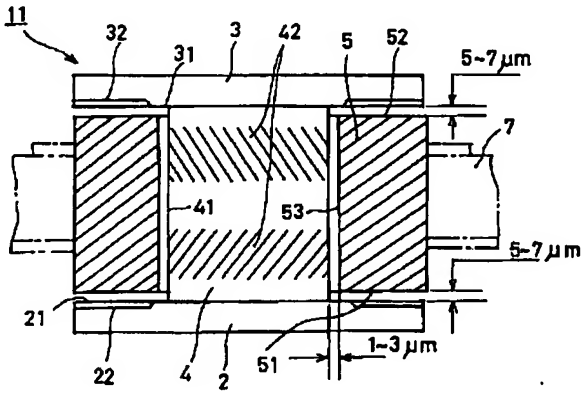
(54)【発明の名称】　動圧軸受

(57)【要約】　(修正有)

【目的】　回転体が傾斜設定、又は、水平設置の場合に於いても回転速度が特に増大された回転体の周辺部がスラスト軸受に接触しないようにする。

【構成】　ラジアル軸受4と、該ラジアル軸受4の両端に設けたスラスト軸受2，3とを有し、前記ラジアル軸受4と、前記スラスト軸受2，3に回転自在に設けられた回転体5を有する。前記回転体5が前記ラジアル軸受と、前記スラスト軸受で受け回転する時、前記回転体と前記スラスト軸受間に生ずる間隙幅の最小値が、前記ラジアル軸受と前記回転体間に生ずる間隙幅の最小値より大となる。



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【特許請求の範囲】

【請求項1】　ラジアル軸受と、該ラジアル軸受の両端に設けたスラスト軸受とを有し、前記ラジアル軸受と、前記スラスト軸受に回転自在に設けられた回転体を有する動圧軸受に於いて、前記回転体が前記ラジアル軸受と、前記スラスト軸受で受け回転する時、前記回転体と前記スラスト軸受間に生ずる間隙幅の最小値が、前記ラジアル軸受と前記回転体間に生ずる間隙幅の最小値より大となることを特徴とする動圧軸受。

【請求項2】　前記動圧軸受に於いて、前記ラジアル軸受と、前記スラスト軸受の両方、或いは少なくとも一方に動圧発生用溝が形成されていることを特徴とする請求項1記載の動圧軸受。

【請求項3】　前記回転体が前記軸受に接触する時は少なくとも周速の小さいラジアル軸受に接触することを特徴とする請求項1～2記載の動圧軸受。

【請求項4】　前記ラジアル軸受はセラミックスで形成されていることを特徴とする請求項1～3記載の動圧軸受。

【請求項5】　ラジアル軸受と、該ラジアル軸受の両端に設けたスラスト軸受とを有し、前記ラジアル軸受と、前記スラスト軸受に回転自在に設けられた回転体を有する動圧軸受に於いて、前記回転体が前記ラジアル軸受と、前記スラスト軸受で受け回転する時、前記回転体と前記スラスト軸受間に生ずる間隙幅の最小値が、前記ラジアル軸受と前記回転体間に生ずる間隙幅の最小値より大となる動圧軸受であって、前記ラジアル軸受と、前記回転体に動圧発生用溝が形成されていることを特徴とする動圧軸受。

【請求項6】　前記回転体が前記軸受に接触する時は少なくとも周速の小さいラジアル軸受に接触することを特徴とする請求項5記載の動圧軸受。

【請求項7】　前記ラジアル軸受はセラミックスで形成されていることを特徴とする請求項5～6記載の動圧軸受。

【請求項8】　ラジアル軸受と、該ラジアル軸受の一端に設けたスラスト軸受とを有し、前記ラジアル軸受と、前記スラスト軸受に回転自在に設けられた回転体を有する動圧軸受に於いて、前記回転体が前記ラジアル軸受と、前記スラスト軸受で受け回転する時、前記回転体と前記スラスト軸受間に生ずる間隙幅の最小値が、前記ラジアル軸受と前記回転体間に生ずる間隙幅の最小値より大となることを特徴とする動圧軸受。

【請求項9】　前記動圧軸受に於いて、前記ラジアル軸受と、前記スラスト軸受の両方或いは少なくとも一方に動圧発生用溝が形成されていることを特徴とする請求項8記載の動圧軸受。

【請求項10】　前記回転体が前記軸受に接触する時は少なくとも周速の小さいラジアル軸受に接触することを特徴とする請求項8～9記載の動圧軸受。

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【請求項11】　前記ラジアル軸受はセラミックスで形成されていることを特徴とする請求項8～10記載の動圧軸受。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は回転体と、非回転体間に動圧発生用溝を形成し、回転体の回転により前記動圧発生用溝の作用で回転体と非回転体間に間隙を形成することにより、回転体の高速回転を可能とした回転機械の動圧軸受に関するものである。

【0002】

【従来の技術】一般に動圧軸受を用いた回転体を設置するには水平設置が基本となっている。そして動圧軸受は、回転体の高速回転により発生する風を非回転体に設けた前記動圧発生用溝に導入し、前記風により、該動圧発生用溝より強力な風圧を前記回転体面に当てることで非回転体面と、回転体面間に数μm単位の空気間隙を形成し、非回転体と、回転体間の抵抗を低下させる事で、回転体の高速回転を可能にしている。前記のような回転体を、固定された前記ラジアル軸受と、スラスト軸受に設けた動圧発生用溝より数μm単位の空気間隙で浮かせながら3000rpm以上の回転数で高速回転するポリゴンミラーに使用した動圧軸受も知られいる（実公平4-38330号、同5-16574号）。

【0003】

【発明が解決しようとする課題】以上のような動圧軸受は前記のように水平に設置されていれば回転体の回転と、動圧発生用溝により発生する風により、前記のように非回転体と、回転体は数μmの空気間隙を保持しながら回転体は回転を維持出来る。前記動圧軸受を使用した回転体に例えば小型のプリンタ、画像記録装置等に使用されているレーザ露光用のポリゴンミラーの回転用に使用した時、設置場所又は部品配置の関係上水平配置が不可能となる場合がある。そこで前記ポリゴンミラーを形成した回転体と共に前記動圧軸受を設置場所に応じて傾斜配置した時、前記のように動圧発生用溝で形成された数μm間隔で形成された空気間隙が保持されず、回転体の一部が対向部面に接触する事故を起こすこともある。前記のようにポリゴンミラーの回転は3000rpm以上の回転数で回転しており、特に回転体の回転中心部より回転周辺部の回転速度が増大している。前記のように回転体を傾斜配置した場合、又は振動等の外部要因により、前記空気間隙による保持が出来ず、回転体の周辺部が前記スラスト軸受の一部に接触してしまう欠点がある。

【0004】本発明は前記のような欠点を改善するため特に考えられたものである。即ち、回転体を受けるラジアル軸受と、スラスト軸受の内、回転体とスラスト軸受との間隙を前記回転体とラジアル軸受との間隙より広く設定出来るように動圧軸受を構成し、回転体が傾斜設定された状態において、又、水平設置の場合に於いても、

回転速度が特に増大された前記回転体の周辺部がスラスト軸受に接触しないようにしたことを目的としたものである。

【0005】

【課題を解決するための手段】本発明は前記目的を達成するため、請求項1に於いて、ラジアル軸受と、該ラジアル軸受の両端に設けたスラスト軸受とを有し、前記ラジアル軸受と、前記スラスト軸受に回転自在に設けられた回転体を有する動圧軸受に於いて、前記回転体が前記ラジアル軸受と、前記スラスト軸受で受け回転する時、前記回転体と前記スラスト軸受間に生ずる間隙幅の最小値が、前記ラジアル軸受と前記回転体間に生ずる間隙幅の最小値より大となること。請求項2に於いて、前記動圧軸受に於いて、前記ラジアル軸受と、前記スラスト軸受の両方、或いは少なくとも一方に動圧発生用溝が形成されていること。請求項3に於いて、前記回転体が前記軸受に接触する時は少なくとも周速の小さいラジアル軸受に接触すること。請求項4に於いて、前記ラジアル軸受はセラミックスで形成されていること。請求項5に於いて、ラジアル軸受と、該ラジアル軸受の両端に設けたスラスト軸受とを有し、前記ラジアル軸受と、前記スラスト軸受に回転自在に設けられた回転体を有する動圧軸受に於いて、前記回転体が前記ラジアル軸受と、前記スラスト軸受で受け回転する時、前記回転体と前記スラスト軸受間に生ずる間隙幅の最小値が、前記ラジアル軸受と前記回転体間に生ずる間隙幅の最小値より大となる動圧軸受であって、前記ラジアル軸受と、前記回転体に動圧発生用溝が形成されていること。請求項6に於いて、前記回転体が前記軸受に接触する時は少なくとも周速の小さいラジアル軸受に接触すること。請求項7に於いて、前記ラジアル軸受はセラミックスで形成されていること。請求項8に於いて、ラジアル軸受と、該ラジアル軸受の一端に設けたスラスト軸受とを有し、前記ラジアル軸受と、前記スラスト軸受に回転自在に設けられた回転体を有する動圧軸受に於いて、前記回転体が前記ラジアル軸受と、前記スラスト軸受で受け回転する時、前記回転体と前記スラスト軸受間に生ずる間隙幅の最小値が、前記ラジアル軸受と前記回転体間に生ずる間隙幅の最小値より大となること。請求項9に於いて、前記動圧軸受に於いて、前記ラジアル軸受と、前記スラスト軸受の両方或いは少なくとも一方に動圧発生用溝が形成されていること。請求項10に於いて、前記回転体が前記軸受に接触する時は少なくとも周速の小さいラジアル軸受に接触すること。請求項11に於いて、前記ラジアル軸受はセラミックスで形成されていることにより達成される。

【0006】

【実施例】図1はポリゴンミラーの回転支持装置1を示し、該回転支持装置1には上下に板状のスラスト軸受2，3を設け、該スラスト軸受2，3間に挟まれるように円柱状のラジアル軸受4を固定した動圧軸受11を設ける。そして前記スラスト軸受2，3の案内面21，31と、ラジアル軸受4の案内面41には各々動圧発生用溝22，32，42を形成する。前記案内面21，31，41に対し回動自在に形成した対向面51，52，53を形成した回転体5を設けると共に、該回転体5は前記ラジアル軸受4を回転中心となるように設け、前記回転体5の外周に取付部材6，61と共にポリゴンミラー7を固定して設ける。前記取付部材6にはステータコイル6Aを設け、前記回転支持装置1には前記ステータコイル6Aに対向したマグネット8が設けられ、前記ステータコイル6Aに通電することで回転体5を高速度で誘導回転させる。

【0007】図2は、前記スラスト軸受2，3及びラジアル軸受4間に於いて、前記回転体5が回転する時の間隙を示すものである。前記スラスト軸受2，3の動圧発生用溝22，32を形成した案内面21，31と、前記回転体5で前記案内面21，31と対向した対向面51，52間を5～7μmとし、前記ラジアル軸受4の案内面41と前記回転体5の対向面53間を1～3μmの空気間隙を保持するように前記動圧発生用溝22，32，42を形成する。前記のような設定により前記回転体5とポリゴンミラー7を高速回転した時に、前記のように傾斜配置又は振動等により前記回転体5の回転位置が多少変位しても前記スラスト軸受2，3の案内面21，31に回転体5の対向面51，52が接触せず、回転体5の対向面53がラジアル軸受4の案内面41に多少接触するのみである。尚前記ラジアル軸受4は接触による磨耗や発熱を防止するためセラミックス材等で形成することも可能である。

【0008】図3は、前記図2と同様に、前記スラスト軸受2，3及びラジアル軸受4間に於いて、前記回転体5が回転する時の間隙として、前記スラスト軸受2，3の案内面21，31と、前記回転体5で前記案内面21，31と対向した対向面51，52間を5～7μmとし、前記ラジアル軸受4の案内面41と前記回転体5の対向面53間を1～3μmの空気間隙を保持するように前記動圧発生用溝22，32，42を形成する。そして本実施例は、前記スラスト軸受2，3の案内面21，31に設けた前記動圧発生用溝22，32に代わって、前記回転体5の対向面51，52に動圧発生用溝511，521を設けたものである。前記のように構成し、前記回転体5とポリゴンミラー7を高速回転した時でも、前記のように傾斜配置又は振動等により前記回転体5の回転位置が多少変位した時でも、前記スラスト軸受2，3の案内面21，31に回転体5の対向面51，52が接触せず、回転体5の対向面53がラジアル軸受4の案内面41に多少接触するのみである。尚前記ラジアル軸受4は接触による磨耗や発熱を防止するためセラミックス材等で形成することも可能である。

【0009】図4は、前記図2の他の実施例で、前記スラスト軸受2，3の内、該スラスト軸受2のみを設けた構成である。本実施例に於いても、前記スラスト軸受2

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の案内面21と、前記回転体5と対向した対向面51間を5～7μmとし、前記ラジアル軸受4の案内面41と、前記回転体5の対向面53間を1～3μmの空気間隙を保持するように前記動圧発生用溝22，42を形成する。そして本実施例は、前記スラスト軸受2の案内面21に設けた前記動圧発生用溝22と、前記ラジアル軸受4の動圧発生用溝42により、前記同様に回転体5とポリゴンミラー7を高速回転した時でも、前記のように傾斜配置又は振動等により前記回転体5の回転位置が多少変位しても、前記スラスト軸受2の案内面21に回転体5の対向面51が接触せず、回転体5の対向面53がラジアル軸受4の案内面41に多少接触するのみである。尚前記ラジアル軸受4は接触による磨耗や発熱を防止するためセラミックス材等で形成することも可能である。

【0010】図5は前記図2に於ける動圧軸受11のラジアル軸受4と、スラスト軸受2，3に対し、回転体5の回転時に於ける間隙条件を示したもので、ラジアル軸受4の案内面41と回転体5の対向面53間を各々R_1，R_2とし、スラスト軸受2，3の案内面21，31と回転体5の対向面51，52間を各々t_1，t_2とする。そして回転体5の回転時に$t_1 < t_2$、及び$R_1 < R_2$である時、$t_1 > R_1$となるように設定する。

【0011】前記実施例の図1，図2，図3，図5に於いて、スラスト軸受2，3の案内面21，31に設けた動圧発生用溝22，32は、例えば一方の案内面21又は案内面31のみに設けてもよい。又前記回転体5の動圧発生用溝511，521も一方のみに設けてもよい。

【0012】図6（a），（b）は前記図2の他の実施例である。本実施例の図6（a）は前記スラスト軸受2，3に於ける前記案内面21，31面を傾斜面211，311とする。即ち該傾斜面211，311は、ラジアル軸受4の案内面41より外方に向かってポリゴンミラー7を設けた前記回転体5の対向面51，52に対し外方に向かって順次離れるように傾斜させ、該傾斜によって生ずるスラスト軸受2，3の最大距離を2～5μmとする。又前記ラジアル軸受4の案内面41と前記回転体5の対向面53間は前記図2と同様に1～3μmとする。従って特に前記対向面51，52面の外周位置は前記傾斜面211，311より大きく離れるように構成される。次に本実施例の図6（b）は前記スラスト軸受2，3に於ける前記案内面21，31を曲面状の傾斜面212，312とする。即ち、該傾斜面212，312はラジアル軸受4の案内面41より外方に向かって前記対向面51，52に対し順次離れるように曲面状で傾斜させ、該傾斜によって生ずるスラスト軸受2，3の最大距離を2～5μmとする。又前記ラジアル軸受4の案内面41と前記回転体5の対向面53間は前記図2と同様に1～3μmとする。従って前記図6（a）と同様に前記対向面51、52面の外周位置は前記曲面状の傾斜面212，312より大きく離れるように構成される。

【0013】以上のように構成した図6（a），（b）

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の実施例において、ポリゴンミラー7を設けた回転体5を3000rpm以上の回転数で回転した時、ラジアル軸受4に設けた動圧発生用溝42で回転体5の対向面53は前記1～3μmの間隙を保持しながら回転する。その際、前記のように動圧軸受11を傾斜して設置したり、振動が発生しても前記回転体5の対向面51，52はスラスト軸受2，3に傾斜して形成した傾斜面211，311，212，312の外周部には接触しない。

【0014】図7（a），（b）は、前記図2の他の実施例である。本実施例の図7（a）は前記ポリゴンミラー7を設けた前記回転体5に於ける前記対向面51，52を傾斜面511，521とする。即ち該傾斜面511，521は前記スラスト軸受2，3の案内面21，31に対し外方に向かって順次離れるように傾斜させ、該傾斜によって生じる回転体5の最大距離を2～5μm とする。又前記ラジアル軸受4の案内面41と前記回転体5の対向面53間は前記図2と同様に1～3μmとする。従って特に前記スラスト軸受2，3の案内面21，31より前記回転体5の外周部は傾斜により大きく離れるように構成される。図7（b）は前記ポリゴンミラー7を設けた前記回転体5に於ける前記対向面51，52を曲面状の傾斜面512，522とする。即ち該曲面状の傾斜面512，522は前記スラスト軸受2，3の案内面21，31に対し外方に向かって順次離れるように傾斜させ、該傾斜によって生じる回転体5の最大距離を2～5μm とする。又前記ラジアル軸受4の案内面41と前記回転体5の対向面53間は前記図2と同様に1～3μmとする。従って特に前記スラスト軸受2，3の案内面21，31より前記回転体5の外周部は傾斜により大きく離れるように構成される。

【0015】以上のように構成した図7（a），（b）の実施例に於いて、ポリゴンミラー7を設けた回転体5を3000rpm以上の回転数で回転した時、ラジアル軸受4に設けた動圧発生用溝42で回転体5の対向面53は前記1～3μmの間隔を保持しながら回転する。その際、前記のように動圧軸受11を傾斜して設置したり、振動が発生しても前記回転体5の対向面51，52に形成した傾斜面511，521，512，522はスラスト軸受2，3の案内面21，31の外周部には接触しない。

【0016】図8は前記図2，図3，図4，図6（a），（b），図7（a），（b）の他の実施例で、前記スラスト軸受2，3に於ける前記案内面21、31面を傾斜面213，313とする。即ち該傾斜面213，313は、ラジアル軸受4の案内面41より外方に向かってポリゴンミラー7を設けた前記回転体5の対向面51，52に対し外方に向かって順次離れるように傾斜させる。又前記ラジアル軸受4の案内面41と前記回転体5の対向面53間は前記図2と同様に1～3μmとする。又前記ポリゴンミラー7を設けた前記回転体5に於ける前記対向面51、52を曲面状の傾斜面513，523とする。即ち該曲面状の傾斜面513，523は前記スラスト軸受2，3の前記傾斜面213，313

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に対し外方に向かって順次離れるように曲面状に傾斜させる。前記スラスト軸受２，３の傾斜面213，313と回転体５の曲面状の傾斜面513，523の二方向の傾斜によって生じる回転体５外周端と、前記スラスト軸受２，３の傾斜面213，313の外周端は大きく離間し、その最大距離を４～10μm とする。従って特に回転体５の外周位置は互いに大きく離れるように構成される。

【００１７】以上のように構成した図８の実施例に於いて、ポリゴンミラー７を設けた回転体５を3000rpm以上の回転数で回転した時、ラジアル軸受４に設けた動圧発生用溝42で回転体５の対向面53は前記１～３μmの間隔を保持しながら回転する。その際、前記のように動圧軸受11を傾斜して設置したり、振動が発生しても前記回転体５に形成した曲面状の傾斜面513，523、スラスト軸受２，３の傾斜面213，313の外周部には接触しない。

【００１８】

【発明の効果】以上のように本発明に於ける動圧軸受は、スラスト軸受と前記回転体間の空気間隙に比べ、中心軸となるラジアル軸受に対向する該回転体の対向面間の空気間隙を小さくするように構成し、特に回転体の速度が増大する外周方向の回転体面とスラスト軸受との接触を防止するようにしたので、ポリゴンミラー等を設けた回転体がスラスト軸受に接触して「かじり」（回転体と軸受が接触して互いの接触面を傷つけ、又は焼付いた状態）の状態となるのを防止出来る。従ってポリゴンミラーを設けた回転体を必要に応じて傾斜設置したり、外部から振動が加わっても、回転速度を3000rpm以上の回転速度で長期間安定した回転を保持することが出来る。

【００１９】又前記回転数を増大したポリゴンミラーを使用した画像形成装置、又はプリンタは、画質をより向

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上させる事及び、高速度に出力を出す事、又周速度の低い位置で接触する構成としたため、前記「かじり」のエネルギーが低くなる事で軸受け材質の選択の幅が広がり、コストダウンを行える効果がある。

【図面の簡単な説明】

【図１】本発明の動圧軸受を使用したポリゴンミラーを示す断面図。

【図２】本発明の動圧軸受と各間隙値を示す断面図。

【図３】本発明の動圧軸受と各間隙値を示す他の実施例の断面図。

【図４】本発明の動圧軸受と各間隙値を示す他の実施例の断面図。

【図５】本発明の動圧軸受と各間隙値の設定を示す断面図。

【図６】本発明の動圧軸受に於ける他の実施例を示す断面図。

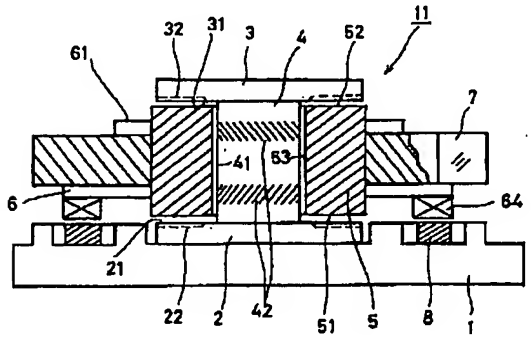
【図７】本発明の動圧軸受に於ける他の実施例を示す断面図。

【図８】本発明の動圧軸受に於ける他の実施例を示す断面図。

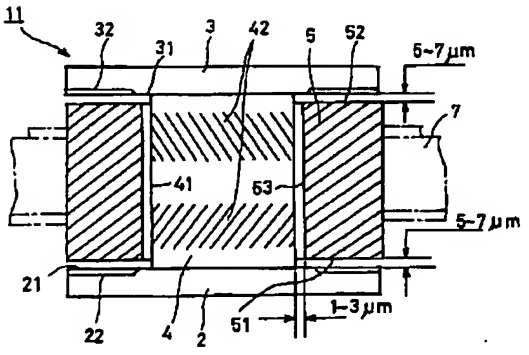
【符号の説明】

1　ポリゴンミラーの回転支持装置
2，3　スラスト軸受
4　ラジアル軸受
5　回転体
7　ポリゴンミラー
22，32，42，511，521　動圧発生用溝
21，31，41　案内面
51，52，53　対向面

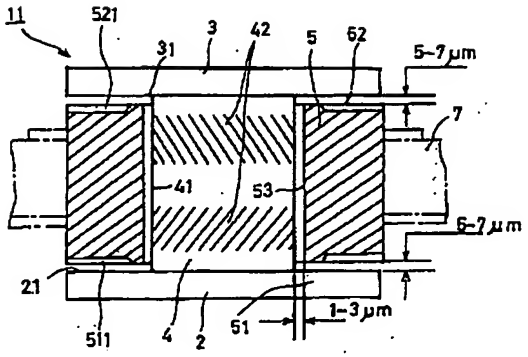
【図１】



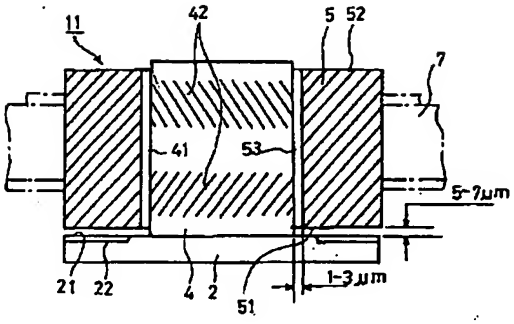
【図２】



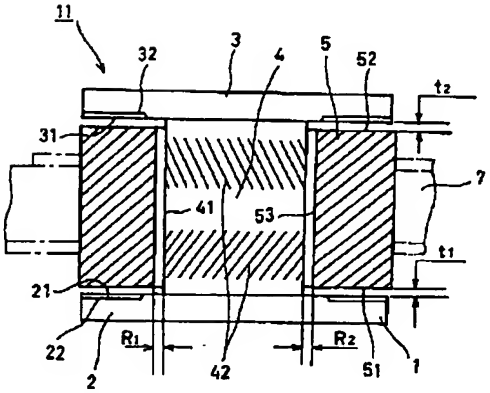
【図3】


11
521
31
3
42
5
62
5-7μm
7
41
53
5-7μm
21
511
4
2
51
1-3μm

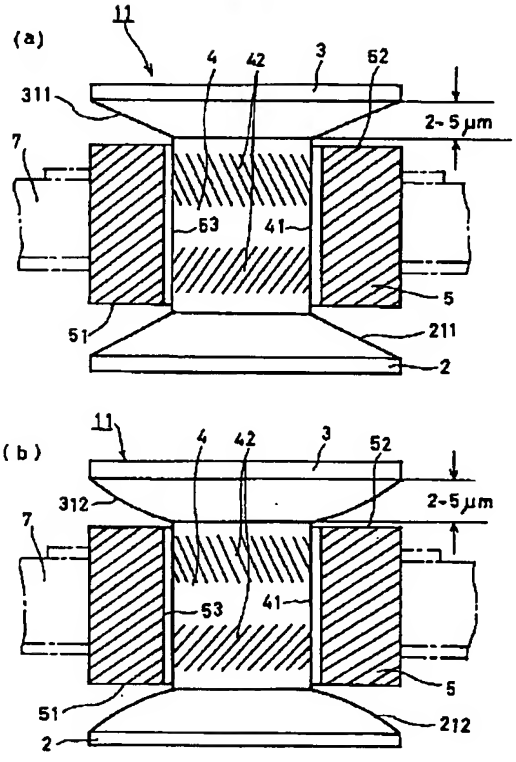
【図4】


11
42
5
52
7
41
53
5-7μm
21
22
4
2
51
1-3μm

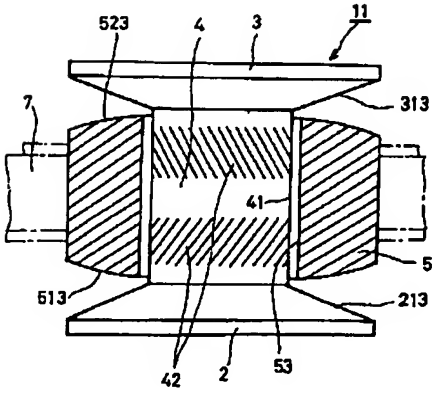
【図5】


11
32
3
4
5
52
t2
31
7
41
53
t1
21
22
R1
R2
2
42
51
1

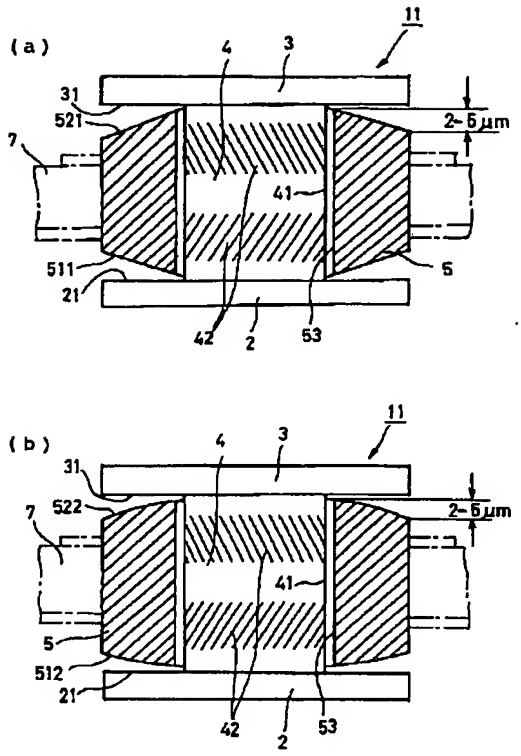
【図6】


(a)
11
4
42
3
62
311
2-5μm
7
63
41
5
51
211
2
(b)
11
4
42
3
52
312
2-5μm
7
53
41
5
51
212
2

【図8】


523
4
3
11
313
7
41
5
513
213
42
2
53

【図7】



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